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(71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON AB (publ) [SE/SE]; S–126 25 Stockholm (SE).

(72) Inventors: RYDBERG, Gunilla, Karin, Maria; Jennyhills väg 9, g, S–433 30 Partille (SE). MÅRDBERG, Elisabet, Lena; Sanataregatan 31A, S–416 53 Göteborg (SE).

(74) Agent: ERICSSON RADIO SYSTEMS AB; Common Patent Dept., S–164 80 Stockholm (SE).

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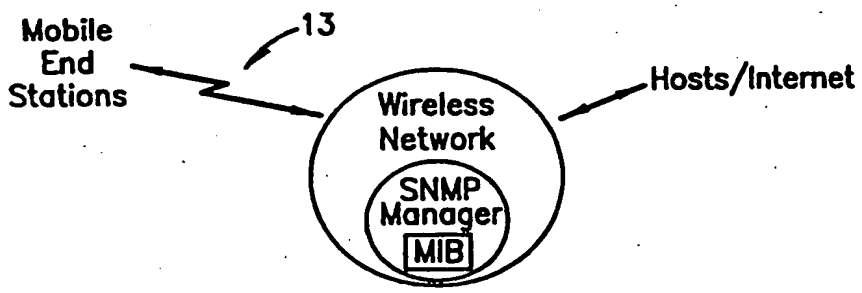
(54) Title: MANAGING GROUP IP ADDRESSES IN MOBILE END STATIONS

(57) Abstract

Management of group IP addresses (81), through which various services are provided to groups of mobile end stations (11) in a wireless network, includes accessing the group IP addresses without manually accessing the mobile end stations. This permits efficient management of the membership of the groups that receive the various services.



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MANAGING GROUP IP ADDRESSES IN MOBILE END STATIONS

FIELD OF THE INVENTION

The present invention relates to services provided to mobile end stations in a wireless network and, more particularly, management of the interface between the service provider and the mobile end stations.

BACKGROUND OF THE INVENTION

FIGURE 1 illustrates a conventional system wherein one or more hosts provide services to various mobile end stations 11 via the Internet, a wireless network and the air interface at 13.

FIGURE 2 illustrates a conventional system similar to that of FIGURE 1, except the hosts that provide the services to the mobile end stations 11 are peer applications located within the wireless network. The hosts provide services to the mobile end stations 11 via the wireless network and the air interface 13.

Many of the services provided by the hosts of FIGURES 1 and 2 are based on the use of Internet Protocol (IP) addresses. Examples of services provided by the hosts include stock market reports, weather reports, and motor vehicle tracking/guidance. Examples of the mobile end stations 11 include interactive (2-way) pagers, mobile telephones, weather report computers, vehicle tracking computers, mobile terminals, and laptop computers with radio modems.

The wireless network of FIGURES 1 and 2 may use the conventional IP protocol as its network protocol, or it may use another conventional communication protocol as its network protocol. For example, the wireless network could be a conventional Mobitex wireless network, which does not use the IP protocol as its network protocol, or the wireless network could be a conventional CDPD (Cellular Digital Pocket Data) wireless network, which uses the IP protocol as its network protocol.

In FIGURE 1, if one of the Internet hosts is running an IP application, then it sends IP traffic to specific IP addresses. The mobile end stations 11 typically include a database of addresses including IP addresses that authorize them to receive various

services corresponding to their IP addresses. So all mobile end stations 11 having an IP address that matches the IP address specified by the IP traffic from the host will receive the service from the host as a group, in point-to-multipoint fashion.

If the wireless network does not use the IP protocol as its network protocol, then the primary address of each mobile end station is the network address assigned by the network protocol of the wireless network. IP addresses within the various mobile end stations of such a wireless network are herein referred to as secondary IP addresses of the mobile end stations.

If the wireless network does use the IP protocol as its network protocol, then each mobile end station will generally have a fixed primary IP address as assigned by the wireless network, and will also include further IP addresses which specify the services provided to the end station. These further IP addresses are also referred to herein as secondary IP addresses.

If a host in the FIGURE 2 system is running an IP application but the wireless network does not use the IP protocol as its network protocol (e.g., the Mobitex network), then the network protocol of the wireless network must be used to convey the IP traffic from the host within the wireless network. This is conventionally accomplished using a gateway GW.

One problem with conventional systems such as shown in FIGURES 1 and 2 is the management of which of the aforementioned secondary IP addresses a particular mobile end station is authorized to use, that is, which services are to be received by which mobile end station. Because of the expense associated with the relatively scarce radio channel resources used in wireless networks, it is particularly important, for example, to be able to quickly add a mobile end station as a subscriber to a given service. Efficient control of which services are supplied to which mobile end stations also provides a bookkeeping tool for service providers.

Some conventional examples of how the aforementioned secondary IP addresses are provided in mobile end stations include (1) entering them in the SIM card of the end station, (2) entering them into the IP stack of, for example, a laptop computer, (3) using proprietary IP address management applications, or (4) entering them manually when the corresponding subscriptions are purchased. In order to use any of the aforementioned techniques for IP address management in a mobile end

station, the mobile end station must disadvantageously be transported to a service center. The aforementioned techniques are then performed by professional personnel at the service center who have manual access to the mobile end station.

It is therefore desirable to provide for management of secondary IP addresses in a mobile end station without requiring the mobile end station to be transported to a service center or manually accessed.

The present invention provides for management of IP addresses in mobile end stations without the need to manually access the mobile end station or transport the mobile end station to a service center for management of its IP addresses. With the present invention, services provided via IP addresses can be subscribed to or canceled without manually accessing the mobile end station or transporting the mobile end station to a service center.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 illustrates a conventional system for delivering services to mobile end stations.

FIGURE 2 illustrates another conventional system for delivering services to mobile end stations.

FIGURE 3 illustrates a system for providing services to mobile end stations according to the present invention.

FIGURE 4 illustrates in greater detail a portion of the mobile end stations of FIGURE 3.

FIGURE 5 illustrates another system for delivering services to mobile end stations according to the present invention.

FIGURE 6 illustrates in greater detail a portion of a host of FIGURE 5.

FIGURE 7 illustrates a portion of the Management Information Base of FIGURES 3, 4 and 6.

FIGURE 8 illustrates in greater detail a portion of the Management Information Base of FIGURE 7.

FIGURE 9 illustrates an arrangement according to the present invention wherein a group owner that provides a service to a group of end stations also manages that service in that group of end stations.

DETAILED DESCRIPTION OF THE DRAWINGS

Example FIGURE 3 illustrates diagrammatically a system according to the present invention wherein a host provides services to mobile end stations via a wireless network as shown in FIGURE 2 or via a combination of the Internet and a wireless network as shown in of FIGURE 1. The system of FIGURE 3 utilizes conventional Simple Network Management Protocol (SNMP) to facilitate management of secondary IP addresses in the mobile end stations. FIGURE 3 illustrates an SNMP Manager provided in the wireless network, and FIGURE 4 illustrates that each of the mobile end stations of FIGURE 3 includes an SNMP Agent.

As is the well known in the art, the Simple Network Management Protocol uses the SNMP Agent of FIGURE 4, namely software that communicates with the SNMP Manager of FIGURE 3. The SNMP Agent stores variables as counters, or stores variables in two-dimensional or simpler tables. In the present invention, the secondary IP addresses of the mobile end station are stored as variables in the SNMP Agent and also in the SNMP Manager.

The conventional SNMP protocol supports a GET function wherein the SNMP Manager retrieves a specified variable's current value from the agent, and also supports a SET function wherein the SNMP Manager sets a variable in the agent to a desired value. If the secondary IP addresses are defined as variables in the SNMP Agent, the SNMP Manager can modify the secondary IP addresses of the end station.

The SNMP variables themselves, that is, the secondary IP addresses within the SNMP Agent, are defined by a Management Information Base (MIB). As shown in FIGURES 3 and 4, the SNMP Manager and the SNMP Agents of the mobile end stations each include an MIB. The SNMP Manager will have an MIB identical to the MIB of each SNMP Agent associated therewith. Thus, if there are six mobile end stations in FIGURE 3, then the SNMP Manager will have six MIBs that respectively match the six MIBs in the SNMP Agents of the six mobile end stations.

In addition to secondary IP addresses, the MIBs of each agent will also typically contain service parameters which make it possible for the SNMP Manager to manage various features of the services by modifying these service parameters. As

mentioned above, it is also possible to have a different MIB (different information) in every agent.

The agents define the MIB version that will be used by the manager in conjunction with that particular agent. It is advantageous to support several versions (i.e., layouts or configurations) of the MIB because this will allow the MIB to be upgraded and will allow the network to gradually migrate from one version of MIB to another. For example, if an additional feature is added to a given service, and a new parameter in the MIB is needed in order to use this feature, then a new version of MIB is installed to permit the subscribing end stations to access the new feature of the service.

FIGURE 5 illustrates a system similar to that of FIGURE 3, except the SNMP Manager is not provided in the wireless network. Rather, as shown in FIGURE 6, an SNMP Manager is provided in one (or more) of the hosts. Thus, a system according to the present invention can include a single SNMP Manger in combination with SNMP Agents for each of the mobile end stations, and the SNMP Manager can be located in the wireless network or in one of the hosts.

Example FIGURE 7 illustrates in greater detail a portion of the MIB of FIGURES 3, 4 and 6. The MIB of FIGURE 7 includes a plurality of group IP addresses. The group IP addresses of FIGURE 7 correspond to the secondary IP addresses described above, but are referred to here as group IP addresses because such IP addresses will typically be contained in a plurality, or group, of mobile end stations. For example, all mobile end stations that subscribe to a particular service will contain the IP address used to deliver that service.

Thus, group IP address 1 of FIGURE 7 could correspond to a stock market update service which is received by a plurality of mobile end stations, each of which includes group IP address 1. Similarly, group IP address 2 could correspond to a weather reporting service, and could be included in a plurality of other mobile end stations which also receive the weather reporting service. Each of the group IP addresses of FIGURE 7 corresponds to a service received by the mobile end station in whose MIB those addresses are located.

Example FIGURE 8 illustrates the information in the MIB associated with a single group IP address such as group IP address 1 of FIGURE 7. The group IP

address itself, indicated at 81 in FIGURE 8, is the address which permits the mobile end station to receive the associated service. The SNMP Manager can use the SNMP SET function to change the group IP address 81 so that the end station receives a different service, or the SNMP Manager can set the group IP address 81 to a null value which prevents the mobile end station from receiving any services via the group IP address at 81.

At 85 in FIGURE 8 is a list of applications which are acceptable for use with the group IP address 81. For example, a list of TCP (Transmission Control Protocol) or UDP (User Datagram Protocol) port numbers could be included here. Then, if the end station receives from a TCP or UDP application traffic directed to the group IP address at 81, but the port number of that application does not appear in the list at 85, then the traffic will be ignored. On the other hand, if the traffic from the TCP or UDP application does include a port number that is included in the list at 85, then the traffic will be accepted. The SNMP Manager can add entries to or remove entries from the list 85 as desired.

An indication of entry time and entrant ID is shown at 87. The entry time provides a record of the time at which the current group IP address at 81 was set into the MIB by the SNMP Manager, and the entrant ID provides identification of the particular SNMP Manager which entered the current group IP address.

The address or group owner information at 83 identifies the current group owner associated with the group of end stations having the group IP address at 81 in common and therefore receiving a service in common. The concept of a group owner is described in more detail below with respect to FIGURE 9.

The MIB structure illustrated in FIGURES 7 and 8 permits the SNMP Manager to manage the group IP addresses in the MIBs of the various mobile end stations. For example, if it is desired to delete two mobile end stations from a particular group that receives motor vehicle traffic reports, and to add three other mobile end stations to that group, then the SNMP Manager would perform the following operations. In the two mobile end stations that are to be deleted from the group, the SNMP Manager would set the group IP address corresponding to the motor vehicle traffic service to a null value. In each of the three mobile end stations that are to be added to the group, the SNMP Manager would set an appropriate one of the group IP addresses, such as at 81,

to the group IP address corresponding to the motor vehicle traffic reporting service. Also, the SNMP Manager could, in the MIBs of the added mobile end stations, record the entry time and set the entrant ID.

FIGURE 10 illustrates a plurality of group owners that each provide services to a group of mobile end stations. Although the wireless network and Internet are omitted in FIGURE 10, it should be clear from the foregoing that the group owners can provide the services to the various groups via the wireless network or via the wireless network and the Internet. Each group owner in FIGURE 10 could be, for example, a host that provides a specified service to a group of mobile end stations. Each group owner in FIGURE 10 has its own SNMP Manager for managing the IP addresses in the end stations of its group. However, regardless of the number of groups and the number of group owners in the system, a single SNMP Manager located in the wireless network or located in one of the hosts can, if desired, be used to manage IP addresses for all end stations in the network.

Although exemplary embodiments of the present invention have been described above in detail, this does not limit the scope of the invention, which can be practiced in a variety of embodiments.

WHAT IS CLAIMED IS:

1. A method of managing a group of mobile end stations each of which contains a group IP address associated with a service that is provided to each of the mobile end stations by a server that uses the group IP address and a wireless network to deliver the service, comprising:

determining that a further mobile end station is to join the group and be added as a subscriber to the service; and

adding the group IP address to the further mobile end station without manually accessing the further mobile end station.

2. The method of Claim 1, wherein said adding step includes using an SNMP manager that is located remotely from the further mobile end station to modify a variable in an SNMP agent provided in the further mobile end station, said using step including modifying the variable from a first value to a second value that differs from the first value and corresponds to the group IP address.

3. The method of Claim 1, including providing within each of the mobile end stations a list of applications from which that mobile end station is permitted to accept communication.

4. The method of Claim 3, wherein said providing step includes using an SNMP manager that is located remotely from the mobile end stations to modify variables in respective SNMP agents provided in the respective mobile end stations.

5. The method of Claim 1, including determining that one of the mobile end stations is to leave the group and be deleted as a subscriber to the service, and removing the IP address from that mobile end station without manually accessing it.

6. The method of Claim 5, wherein said removing step includes using an SNMP manager that is located remotely from the one mobile end station to modify a variable in an SNMP agent provided in the one mobile end station.

7. The method of Claim 1, including modifying a service parameter associated with the service and stored in one of the mobile end stations without manually accessing the one mobile end station.

8. The method of Claim 7, wherein said modifying step includes using an SNMP manager that is located remotely from the one mobile end station to modify a variable in an SNMP agent provided in the one mobile end station.

9. The method of Claim 1, wherein one of the mobile end stations is one of an interactive pager, a mobile telephone, a mobile terminal, a computer, and a radio modem.

10. The method of Claim 1, wherein the service is one of stock market reporting, weather reporting and motor vehicle tracking services.

11. The method of Claim 1, wherein the server accesses the wireless network via the Internet.

12. A method of managing a group of mobile end stations each of which contains a group IP address associated with a service that is provided to each of the mobile end stations by a server that uses the group IP address and a wireless network to deliver the service, comprising:

determining that one of the mobile end stations is to leave the group and be deleted as a subscriber to the service; and

removing the group IP address from the one mobile end station without manually accessing the one mobile end station.

13. The method of Claim 12, wherein said removing step includes using an SNMP manager that is located remotely from the one mobile end station to modify a variable in an SNMP agent provided in the one mobile end station, said using step including modifying the variable from a first value that corresponds to the group IP address to a second value that differs from the first value.

14. The method of Claim 12, including providing within each of the mobile end stations a list of applications from which that mobile end station is permitted to accept communication.

15. The method of Claim 14, wherein said providing step includes using an SNMP manager that is located remotely from the mobile end stations to modify variables in respective SNMP agents provided in the respective mobile end stations.

16. The method of Claim 12, including modifying a service parameter associated with the service and stored in one of the mobile end stations without manually accessing the one mobile end station.

17. The method of Claim 16, wherein said modifying step includes using an SNMP manager that is located remotely from the one mobile end station to modify a variable in an SNMP agent provided in the one mobile end station.

18. The method of Claim 12, wherein one of the mobile end stations is one of an interactive pager, a mobile telephone, a mobile terminal, a radio modem, and a computer.

19. The method of Claim 12, wherein the service is one of stock market reporting, weather reporting and motor vehicle tracking services.

20. The method of Claim 12, wherein the server accesses the wireless network via the Internet.

21. A mobile end station for use with a wireless communication network, comprising:

a memory for storing a group IP address therein, said group IP address associated with a service that is provided to a group of mobile end stations by a server that uses the group IP address and the wireless network to deliver the service; and

an input for permitting said group IP address to be stored in and removed from said memory via the wireless network without manually accessing said mobile end station.

22. The system of Claim 21, including an SNMP Agent accessible from said input, said memory associated with said SNMP Agent.

23. A wireless communication system, comprising:

a wireless communication network;

a plurality of mobile end stations coupled to said wireless communication network;

a host server coupled to said wireless communication network for providing a service to said mobile end stations via said wireless communication network;

each said mobile end station including a memory for storing a group IP address therein, said host server providing said service to any of said mobile end stations having said group IP address stored therein; and

a group manager coupled by said wireless network to said mobile end stations and operable to store said group IP address in said mobile end stations and remove said group IP address from said mobile end stations without manually accessing said mobile end stations.

24. The system of Claim 23, wherein said group manager includes an SNMP manager.

25. The system of Claim 24, wherein said mobile end stations each include an SNMP agent which cooperates with said SNMP manager, said memory of each said mobile end station associated with said SNMP agent of said mobile end station.

26. The system of Claim 24, wherein said host server includes said group manager.

27. The system of Claim 26, wherein said host server is coupled to said wireless network by the Internet.

28. The system of Claim 24, wherein said group manager is provided in said wireless network.

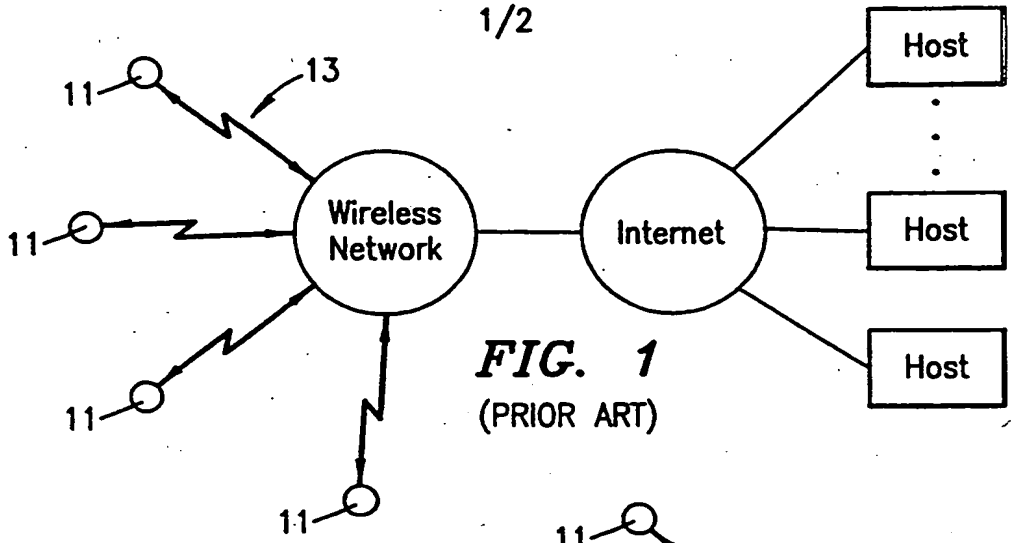

FIG. 1
(PRIOR ART)

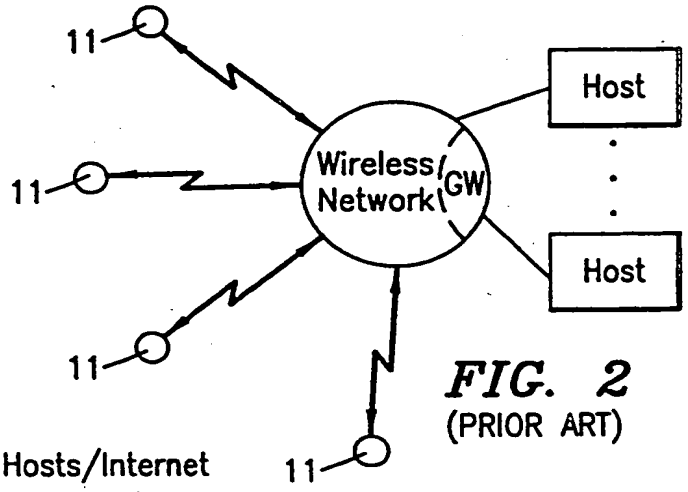

FIG. 2
(PRIOR ART)

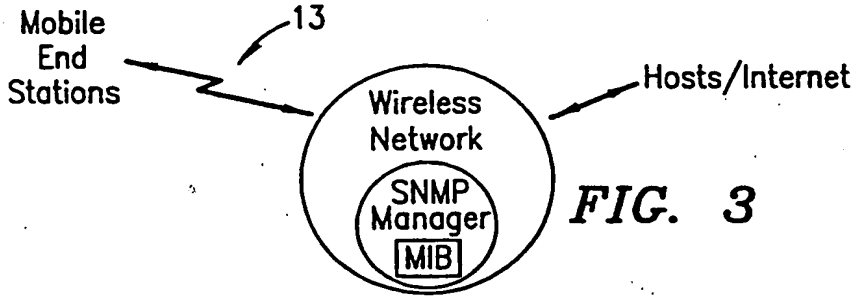

FIG. 3

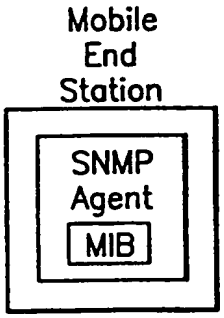

FIG. 4

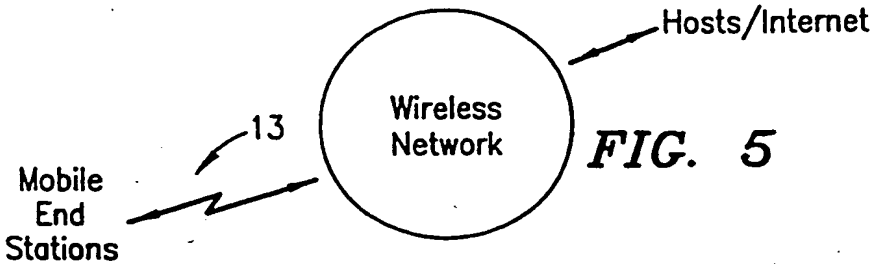

FIG. 5

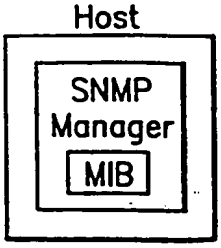

FIG. 6

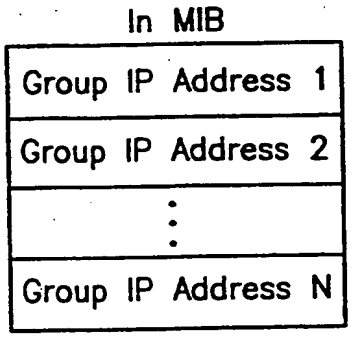

FIG. 7

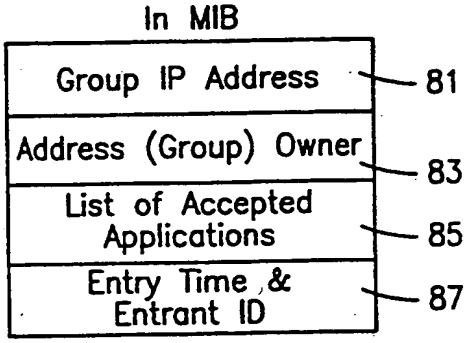

FIG. 8

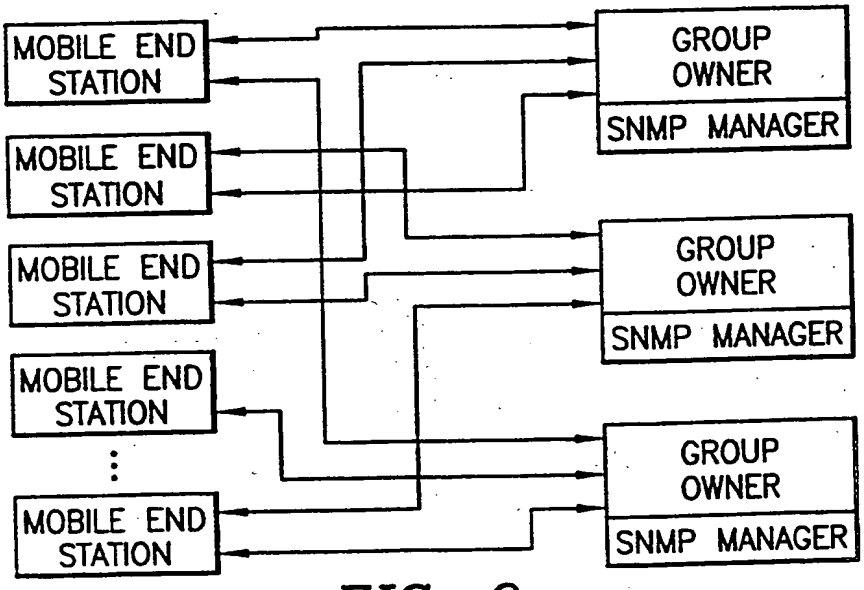

FIG. 9

INTERNATIONAL SEARCH REPORT

International Application No
PCT/SE 99/00054

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L12/24 H04L12/28 H04L29/12 H04L12/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 675 660 A (ALCATEL BELL SDT SA ;ALCATEL NV (NL)) 4 October 1995 see abstract	1,3,5,7, 9,12,14, 18,21,23
Y	see page 2, column 1, line 1 - column 2, line 47 see page 3, column 4, line 1 - line 11	10,11, 19,20
A	see page 5, column 7, line 2 - line 13 see page 5, column 8, line 54 - page 6, column 9, line 42 see claims 1,2,4,5,7,8	16,28
Y	EP 0 794 642 A (NOKIA MOBILE PHONES LTD) 10 September 1997 see page 3, column 3, line 52 - column 4, line 7	10,11, 19,20
A	see page 3, column 4, line 45 - line 57	9,18,27

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Ir. ıtional Application No
PCT/SE 99/00054

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	UJIIE K: "A PERFORMANCE EVAULATION METHOD THAT USES SIMPLE NETWORK MANAGEMENT PROTOCOL FOR RADIO LOCAL AREA NETWORKS" ELECTRONICS & COMMUNICATIONS IN JAPAN, PART I - COMMUNICATIONS, vol. 79, no. 10, October 1996, pages 10-16, XP000642672 see the whole document ---	2,4,6,8, 13,15, 17,22, 24-26
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Information on patent family members

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